A STUDY OF NUMERICAL METHODS FOR SOLVING DIFFERENTIAL EQUATIONS

Introduction:

Numerical Methods are involved in almost every field engineering. The problems which are solved by with or without analytical method that can be solved by numerical methods and the result can be compared with the analytical solutions. Numerical methods are used to find the roots of complicated functions, solution of sets of linear algebraic equations, interpolation and extrapolation of tabular data, solution of ordinary differential equations and partial differential equations. The applications of ordinary differential equations are in control theory optimization, electric circuit, dynamics, kinetics, stability and other fields. The applications of P.D.E. are in electrostatic and electromagnetic field theory etc.

The solution of many problems requires repetitive calculations. We know that numerical methods to solve ordinary differential equations are Euler's method, Modified Euler's methods, Runge Kutta 2^{nd} and 4^{th} order ,Picard's method. Programs for these methods are developed in several computer languages like C, C++, Fortran 77,Fortran 90. Now we will develop these programs in advanced computer language VBA with excel. There are a number of commercial software packages available for solving differential equations. VBA spreadsheets were used in recent years as an educational tool in various engineering problems. By using micros spreadsheet programs can be developed to function similar to program written in conventional programming languages.

VBA i.e. Visual Basic for Applications which is a part of all Microsoft office programs. We use it with extensively with Excel. Many mathematical and non mathematical functions which are available in excel but not directly iv VBA, are accessible in the VBA code via special commands using the 'worksheetfunction' commands. Tay, et, al(2009) solved the system of nonlinear equations using spreadsheet. Notice that Tay, et, al(2013a, 2013b,2014)have developed spreadsheet calculator for numerical methods. The combination of excel and VBA is a very powerful engineering tool. It is compatible with other similar language like C, C++, VB.

Review of Literature and development in the subject:

In the journal 'Applied Numerical Mathematics (1999)' ,D.W. Zingg, T.T. Chisholm give idea about solution of linear ordinary differential equations by using higher order Runge Kutta Methods. A series of pares working on solving numerical problems in a classrooms and for examination purpose using spreadsheets have been discussed. Tay, et,al (2009b) solved system of nonlinear equations using spreadsheet. Kek and Tay (2008) developed a solver for system of linear equations in spreadsheet without using VBA programming. Newton's divided interpolation solver in spreadsheet was developed by Kek and Tay(2009c) and Langrage interpolating solver spreadsheet wasdeveloped by Tay (2014). IJCSNS Journal of computer science and network Security Vol.14 No.1 January 2014, Rubiha Saleem Kareem gives numerical methods for fractional differential equations. In the 4^{th} world congress on Technical and vocational education and Training 5^{th} 6^{th} Nov.2014,Malaysia,Kim Gaik Tay, Sia Long Kek, Tau Han Cheong, Rosmila Abdul-Kahar and Ming Foong Lee were introduced "The fourth order Runge Kutta Spreadsheet calculator using VBA Programming for ordinary differential equation.

Objectives:

1. To discuss and compare numerical methods to solve the differential equations.
2. To develop the programs of numerical methods by using advanced computer language (VBA).
3. To propose new method to approximate ordinary differential equation.
4. To use of new method to solve differential equation.
5. To compare and to discuss the result of accuracy between numerical value and output of the programming.

Methodology to be adopted:

- Descriptive method.
- Experimental method.

Importance of Study/Society applications:

Numerical Methods for ordinary differential equations are used to find numerical approximations to to the solutions of differential equations. The aim to

propose new method to solve differential equations is to get more approximate solutions. Solver can get answer very near to exact solution. The question is why VBA? VBA is a advanced computer language, very few researchers are familiar with this language. The combination of excel and VBA is a very powerful engineering of excel and VBA is very powerful engineering tool. Reading and writing data from spreadsheets or files is easy and we can build decent interfaces if you want. We can access Excel charts, solver and pivot table. It is very user friendly since users only need to enter the relevant information to find solutions. We hope this VBA spreadsheet calculator could as a numerical Differential tool that is convenient for the community of educators and students.

Proposed work Plan/Formulation and Structure of Study:

1) Introduction: (Background Enhancement)

   A comprehensive of text-books that covers Numerical Methods for solving Differential equations.

2) Review of literature: (Research Survey)

   In this part, I will use the literature survey of research work (thesis and journals) which are related to my work.

3) Focusing on numerical methods:
   * Initial value problems for ordinary differential equations.
   * Numerical Methods for differential equations.

4) Research work:

   After completing and discussing first three parts, I will receive guidance from my supervision about what problem in certain area to tackle.

   i. Start solving problems using other existing numerical solvers.
   ii. Solve the problems using computer programming.
   iii. A comparison will be made with the numerical result and computer programming.

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